are cut to any figure desired, from stiff corrugated strawboard packing, double faced. This is very strong; the finished disc or occulting screen weighs less than a half-ounce, and to change one disc for another occupies but four or five seconds.

The critical part of the apparatus is of course the heart-shaped figure within a' b', and attached to it at the points l, m, and n.

By carefully calculating the relative arc-values of exposure, central about c', it is easy to lay out a curve, point by point, and cut the corresponding disc, which, as the occulter whirls round, shall give any desired integral of exposure to the corona on a single plate, from $0^{s}\cdot1$ close to the Moon's limb up to 30^{s} at $30'$ distance.

The extraordinary length of totality in 1901 affords a ready opportunity for the substitution of several discs, calculated on different data as to the actinic intensity of the coronal light at various distances from the limb. There will be abundant time also for two or three exposures with each type of occulting disc. The size of the Moon's disc in the instrument I have adapted is $1^{m}\cdot8$—a 12-inch metal speculum of 15 feet focal length. For the photographic part I am depending upon the Standard Eastman films backed, as exhibiting less halative effect than glass plates. The mirror has a simple mounting moved by the glycerine clock, which affords that readiness of quick and accurate adjustment necessary to get the Moon's image exactly central round the c' of the occulter, and to maintain it there during the long totality.

What the new occulter is capable of doing I hope to be able to tell better after the eclipse is over. In rebuilding it I should make two further improvements: (a) to put the occulting disc within a few millimetres of the focal plane; (b) to rotate it by a clockwork whose rate is instantly changeable within wide limits, as I think the occulter should turn round not only at a perfectly uniform rate, but should make only one complete rotation during a single exposure, whatever its length. But these changes must be reserved for 1904.

Mean Areas and Heliographic Latitudes of Sun-spots in the year 1900, deduced from Photographs taken at the Royal Observatory, Greenwich, at Dehra Dûn (India) and in Mauritius.

(*Communicated by the Astronomer Royal.*)

The results here given are in continuation of those printed in the *Monthly Notices*, vol. lxi. p. 3, and are deduced from the measurements of photographs taken at the Royal Observatory, Greenwich; at Dehra Dûn, India; and at the Royal Alfred Observatory, Mauritius.

Table I. gives the mean daily areas of umbræ, whole spots, and faculæ for each synodic rotation of the Sun in 1900; and Table II. gives the same particulars for the entire year 1900 and the eleven preceding years for the sake of comparison. The areas are given in two forms: first, projected areas, that is to say, as millionths of the Sun's apparent disc; and, next, areas as corrected for foreshortening, the areas in this case being expressed in millionths of the Sun's visible hemisphere.

Table III. exhibits for each rotation in 1900 the mean daily area of whole spots, the mean heliographic latitude of the spotted area, and the mean distance from the equator of all spots; and Table IV. gives the same information for the year as a whole, similar results from 1889 to 1899 being added, as in the case of Table II. Tables II. and IV. are thus in continuation of the similar tables for the years 1874 to 1888 on pp. 381 and 382 of vol. xlix. of the *Monthly Notices*.

The rotations in Table I. and Table III. are numbered in continuation of Carrington's series (Observations of Solar Spots made at Redhill by R. C. Carrington, F.R.S.), No. 1, being the rotation commencing 1853 November 9. The assumed prime meridian is that which passed through the ascending node at mean noon on 1854 January 1, and the assumed period of the Sun's sidereal rotation is 25·38 days. The dates of the commencement of the rotations are given in Greenwich civil time, reckoning from mean midnight.

Table I.

No. of Rotation.	Date of Commencement of each Rotation.	No of days on which Photographs were taken.	Mean of Daily Areas. Projected. Umbræ.	Projected. Whole Spots.	Projected. Faculæ.	Corrected for foreshortening. Umbræ.	Corrected. Whole Spots.	Corrected. Faculæ.
	1899.							
618	Dec. 7·76	27	10	70	236	7	51	277
	1900.							
619	Jan. 4·09	27	16	99	161	10	63	182
620	Jan. 31·42	25	18	133	327	13	114	376
621	Feb. 27·77	26	31	155	215	26	136	242
622	Mar. 27·08	27	22	124	221	15	87	257
623	Apr. 23·35	28	50	253	312	30	154	388
624	May 20·58	26	19	91	241	14	68	296
625	June 16·78	27	52	163	104	51	134	152
626	July 13·99	27	16	58	126	10	39	137
627	Aug. 10·20	27	6	28	36	5	23	48
628	Sept. 6·45	27	8	21	95	5	13	120
629	Oct. 3·72	28	54	210	88	42	159	104
630	Oct. 31·01	27	5	18	66	3	12	77
631	Nov. 27·32	28	0	0	14	0	0	23

TABLE II.

Year.	No. of days on which Photographs were taken.	Mean of Daily Areas.					
		Projected.			Corrected for foreshortening.		
		Umbræ.	Whole Spots.	Faculæ.	Umbræ.	White Spots.	Faculæ.
1889	360	17·9	103	107	13·1	78·0	131
1890	361	21·3	133	273	15·5	99·4	304
1891	363	120	745	1322	86·2	569	1412
1892	362	255	1596	3230	186	1214	3270
1893	362	327	1983	2287	234	1464	2404
1894	364	317	1728	1666	231	1282	1877
1895	364	237	1330	2059	169	974	2278
1896	364	127	745	1243	90	543	1410
1897	364	122	695	977	88	514	1149
1898	363	93	532	767	64	375	891
1899	364	27	159	297	18	111	337
1900	360	22	101	150	17	75	180

TABLE III.

No. of Rotation.	Date of Commencement of each Rotation.	No. of Days on which Photographs were taken.	Spots north of the Equator.		Spots south of the Equator.		Mean Heliographic Latitude of Entire Spotted Area.	Mean Distance from Equator of all Spots.
			Mean of Daily Areas.	Mean Heliographic Latitude.	Mean of Daily Areas.	Mean Heliographic. Latitude		
	1899.			°		°	°	°
618	Dec. 7·76	27	29	7·16	22	11·61	− 0·97	9·09
	1900.							
619	Jan. 4·09	27	56	7·84	7	11·32	+ 5·65	8·24
620	Jan. 31·42	25	105	9·48	10	9·63	+ 7·89	9·50
621	Feb. 27·77	26	2·5	4·38	134	11·99	− 11·69	11·85
622	Mar. 27·08	27	15	7·18	72	11·13	− 8·02	10·46
623	Apr. 23·35	28	24	4·35	130	7·57	− 5·57	7·08
624	May 20·58	26	56	3·83	11	8·06	+ 1·86	4·53
625	June 16·78	27	65	4·38	69	6·95	− 1·43	5·70
626	July 13·99	27	4	8·09	36	6·43	− 5·09	6·58
627	Aug. 10·20	27	14	3·49	9	13·13	− 3·29	7·43
628	Sept. 6·45	27	3	7·95	9	4·71	− 1·54	5·52
629	Oct. 3·72	28	0·0	...	159	5·56	− 5·56	5·56
630	Oct. 31·01	27	12	9·52	0·8	6·95	+ 8·49	9·36
631	Nov. 27·32	28	0·0	...	0	...	...	...

TABLE IV.

Year.	No. of Days on which Photographs were taken.	Spots north of the Equator. Mean of Daily Areas.	Spots north of the Equator. Mean Heliographic Latitude.	Spots south of the Equator. Mean Daily Areas.	Spots south of the Equator. Mean Heliographic Latitude.	Mean Heliographic Latitude of Entire Spotted Area.	Mean Distance from Equator of all Spots.
			°		°	°	°
1889	360	5·0	7·26	73·0	11·90	−10·68	11·61
1890	361	53·1	22·20	46·3	21·75	+ 1·73	21·99
1891	363	401	20·49	169	19·91	+ 8·52	20·31
1892	362	607	15·09	607	21·69	− 3·29	18·39
1893	360	517	14·91	941	14·26	− 3·93	14·49
1894	364	543	12·31	739	15·56	− 3·75	14·18
1895	364	565	14·26	409	12·54	+ 3·01	13·54
1896	364	203	13·60	340	14·77	− 4·15	14·33
1897	364	196	8·32	318	7·73	− 1·62	7·96
1898	363	110	9·82	266	10·77	− 4·75	10·49
1899	364	23	6·18	88	10·43	− 6·95	9·54
1900	360	26	6·61	49	8·34	− 3·12	7·74

The principal features of the record for 1900 are :—

1. The decline in areas of umbræ, whole spots and faculæ has been continued, the mean daily spotted area being about two-thirds, and the amount of faculæ about half the corresponding quantities for 1899.

2. The decrease in the area of the umbræ is slight.

3. The northern hemisphere has, as in 1899, been much the less active, giving only one-third of the total mean spotted area.

4. Only seven groups seen for at least ten days and with an average area exceeding 100 millionths of the hemisphere appeared during the year, viz. :—January 28–February 6, March 26–April 17, April 27–May 6, April 27–May 6, May 21–June 1, June 15–24, October 17–28. The second and fifth of these groups may be identified with groups seen in a previous rotation ; the third and fourth which form one large group with a group in a subsequent rotation.

5. There has been a further approach towards the equator in the mean latitude of spots.

6. Out of 360 days on which photographs were obtained there were 191 days without spots, 205 without faculæ, and 79 of these days were without spots or faculæ.

7. The minimum does not appear to have been reached in 1900 ; at the date of this paper (1901 July) no spot of high latitude marking the beginning of a new cycle has been seen.

1901 *July.*

Sun-spots and Magnetic Disturbance. By William Ellis, F.R.S.

The paper by Father Sidgreaves, appearing in vol. 54 of the *Memoirs of the Royal Astronomical Society*, "On the Connexion between Solar Spots and Earth-magnetic Storms," takes up a difficult subject. The general correspondence between the rise and fall of solar spots and terrestrial magnetism, whether measured by the variation of magnetic diurnal range or by the number of days of magnetic disturbance and storm, has been sufficiently well shown; but as regards correspondence in individual particulars, little that is really satisfactory has been so far evolved. The Rev. A. L. Cortie (*Monthly Notices* for 1900 May), in treating of the duration of Sun-spots, has shown that numerous groups are seen through several successive rotations of the Sun, but the author of the paper first mentioned has carried the matter further, by undertaking a considerable discussion of the question of the extent to which relation between individual solar spots and terrestrial magnetic disturbances and storms may be traced. Any serious consideration of this question deserves attention, since such work usually involves much labour. The general effect observable by those who have studied the matter is that, in our latitude, there may be at one time a large solar spot with great magnetic disturbance accompanied by remarkable aurora (as in 1882 November and in 1898 September), when Sun, Earth, and Earth's atmosphere are all involved; at another time a considerable solar spot may appear without accompaniment of unusual magnetic movement; and again magnetic disturbance may occur without any noteworthy spot.

Lord Kelvin, in his presidential address to the Royal Society in 1892, estimating the amount of work which must be done at the Sun to produce a terrestrial magnetic storm, considered the result obtained as absolutely conclusive against the supposition that terrestrial magnetic storms are due to magnetic or other action of the Sun, adding that it seems as if we may be forced to conclude that the supposed connection between magnetic storms and Sun spots is unreal, and the seeming agreement between the periods a mere coincidence. But to show that the Sun does not directly produce magnetic disturbance was not to prove that no relation existed, or that the agreement between the periods was accidental. The fact of general relation, however it is to be explained, is so far evident that theory must take account of it (*Proc. Royal Society*, vol. lxiii. p. 64). Lord Kelvin, in demonstrating the improbability of the existence of direct connection, may be understood to have had more in mind such a circumstance as the simultaneous observation by Carrington and Hodgson of an outburst on the Sun on 1859 September 1, corresponding in time with a magnetic movement shown on the photographic magnetic records, to which indeed he had referred in an earlier